US 20110049255A1

(19) **United States**

(12) **Patent Application Publication**

Penny

(10) **Pub. No.: US 2011/0049255 A1**

(43) **Pub. Date: Mar. 3, 2011**

(54) **METHOD AND ARRANGEMENT FOR RAIL TRACK FIXING**

(76) Inventor: **Charles Penny**, Derby (GB)

(21) Appl. No.: **11/988,843**

(22) PCT Filed: **Jun. 26, 2006**

(86) PCT No.: **PCT/GB2006/002340**

§ 371 (c)(1),
(2), (4) Date: **Nov. 8, 2010**

(30) **Foreign Application Priority Data**

Jul. 19, 2005 (GB) 0514786.3

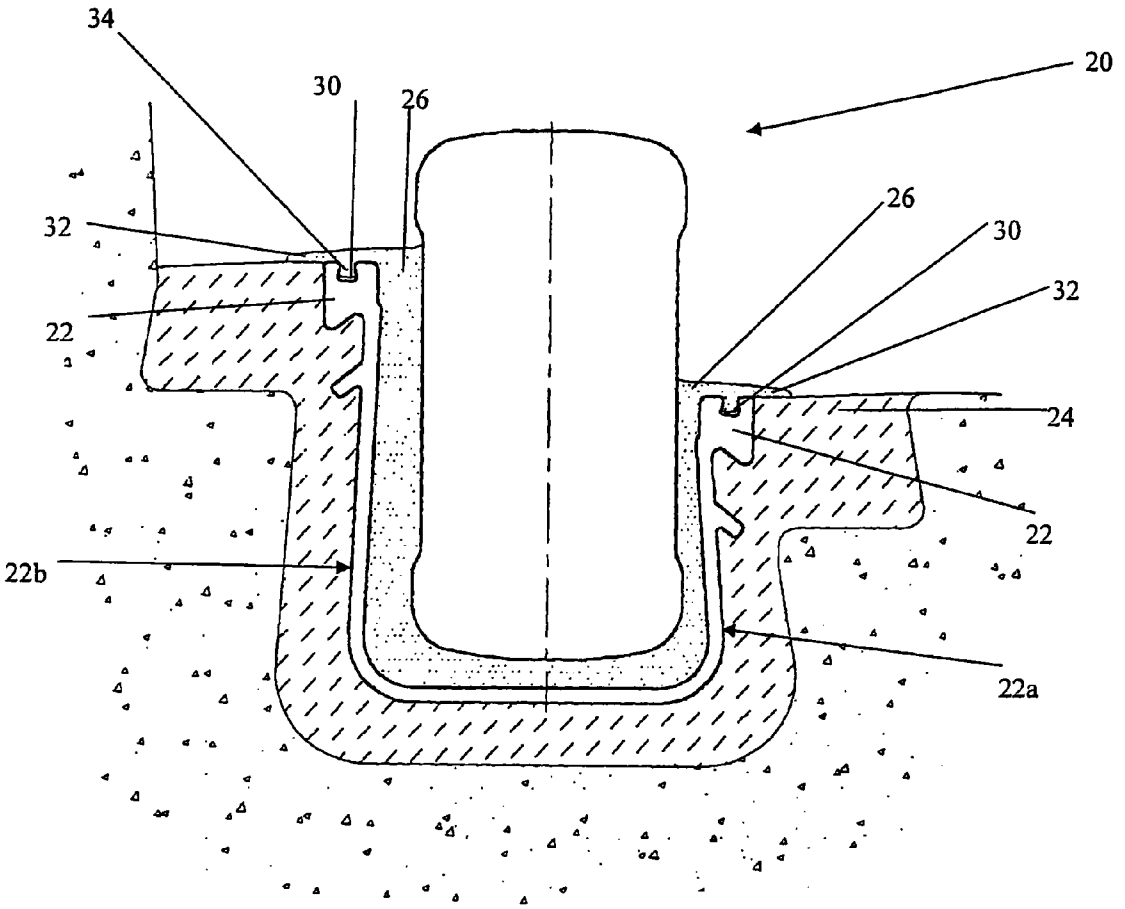
Publication Classification

(51) **Int. Cl.**
E01B 9/62 (2006.01)
E01B 9/38 (2006.01)

(52) **U.S. Cl.** **238/283**; 238/264

(57) **ABSTRACT**

A rail track arrangement has a rail, a sheath or shell which receives the rail and a resilient layer between the sheath and the rail. The sheath has mounting points at an upper surface of each side of the sheath, and upper side portions of the resilient layer extends laterally over the mounting points at each side of the sheath and engage with the mounting points. The upper surface mounting points for the sheath can be used for positioning of the sheath, and enable the sheath to be grouted into position in a one stage process. The mounting points enable the sheath to be installed without the rail, with high accuracy.



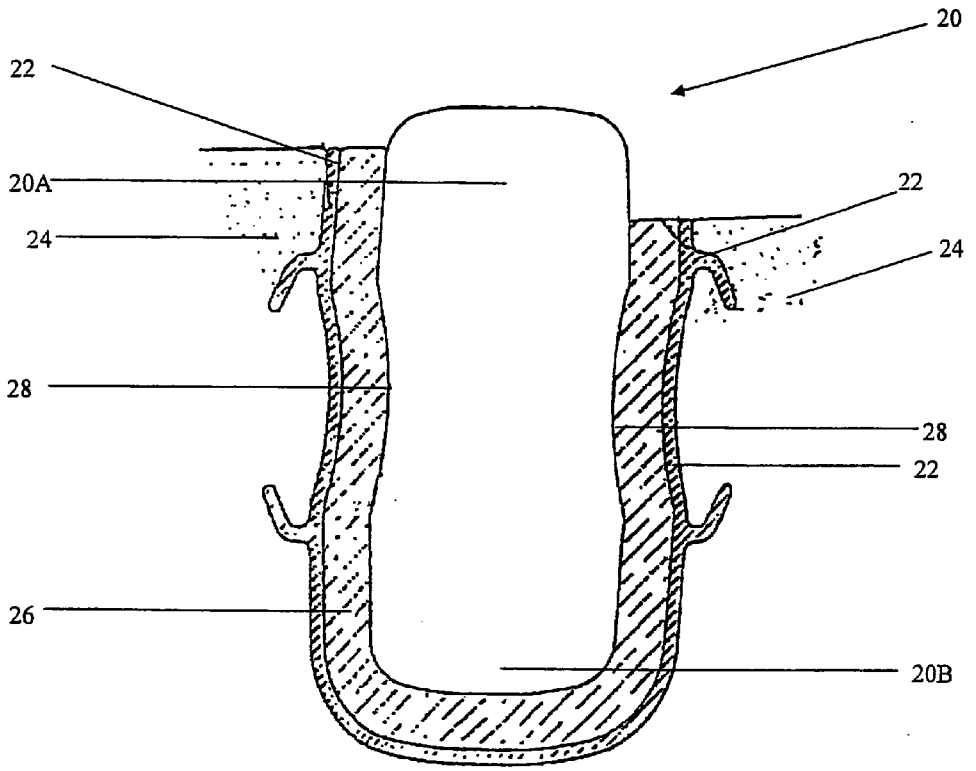


FIGURE 1

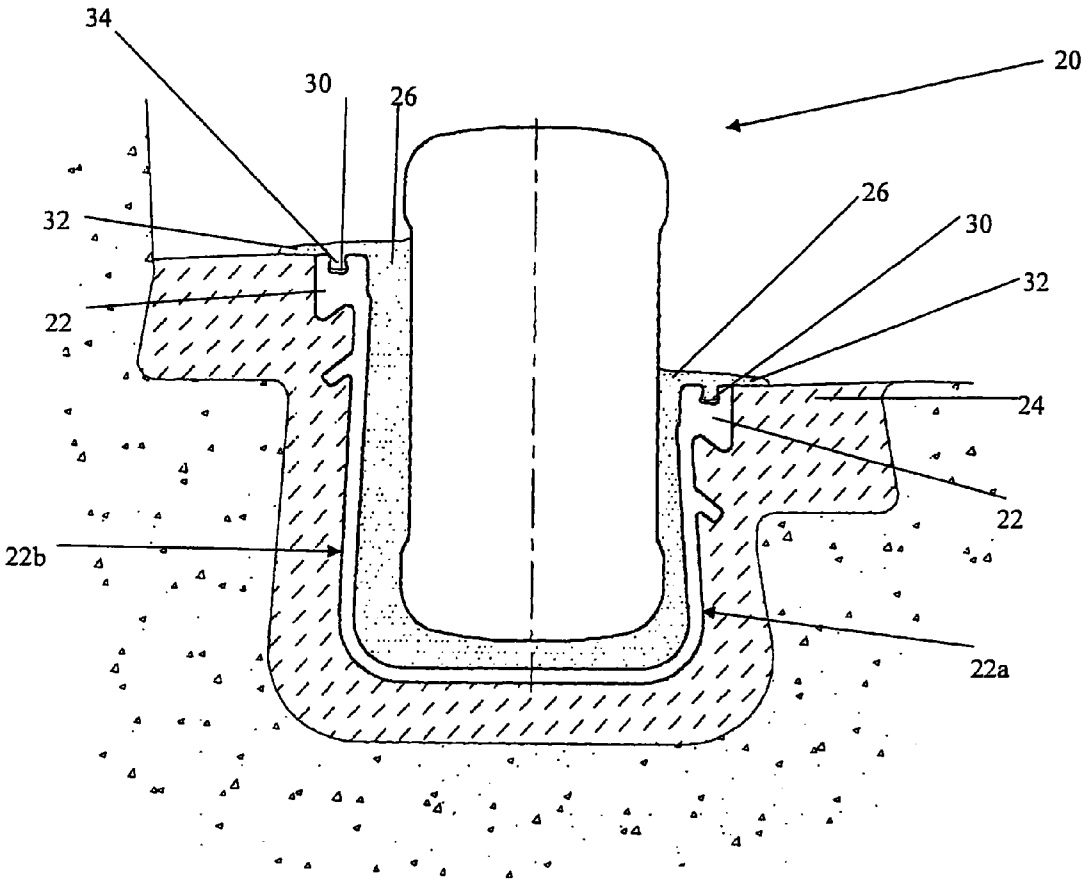


FIGURE 2

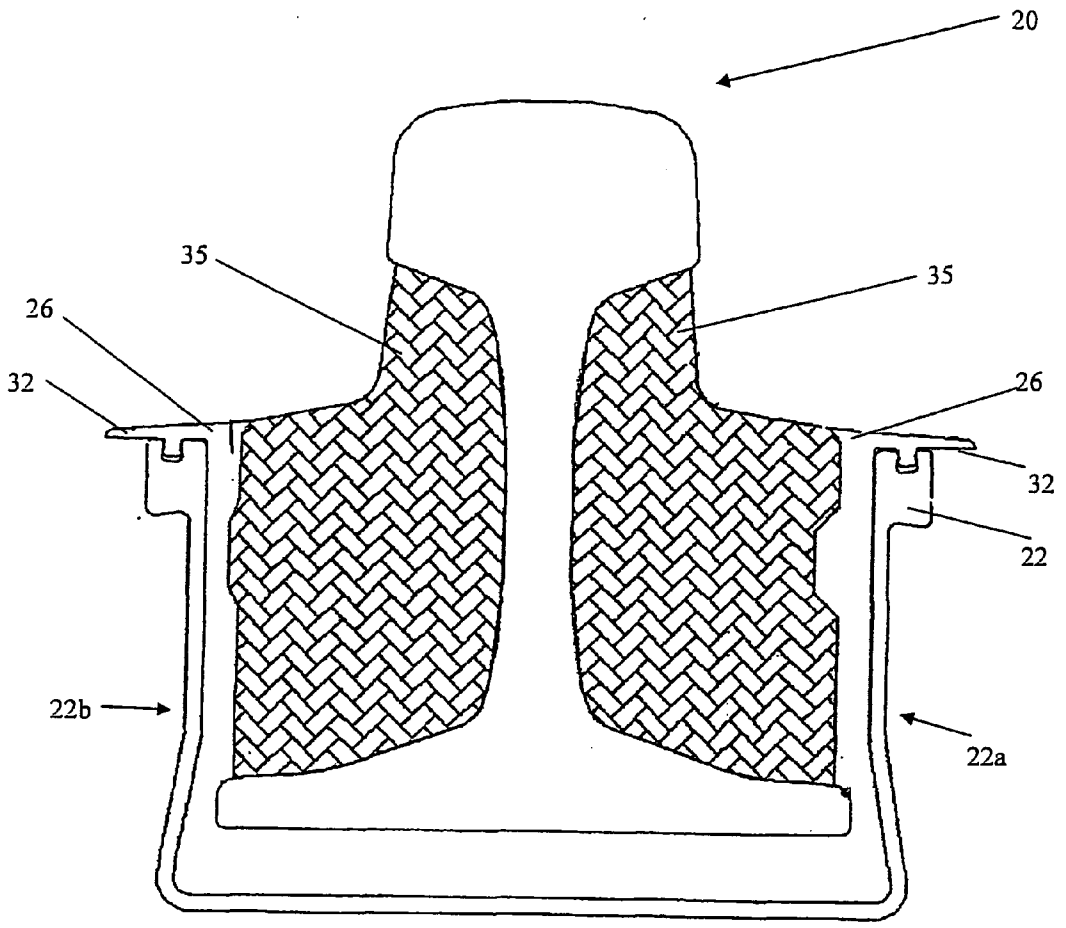


FIGURE 3

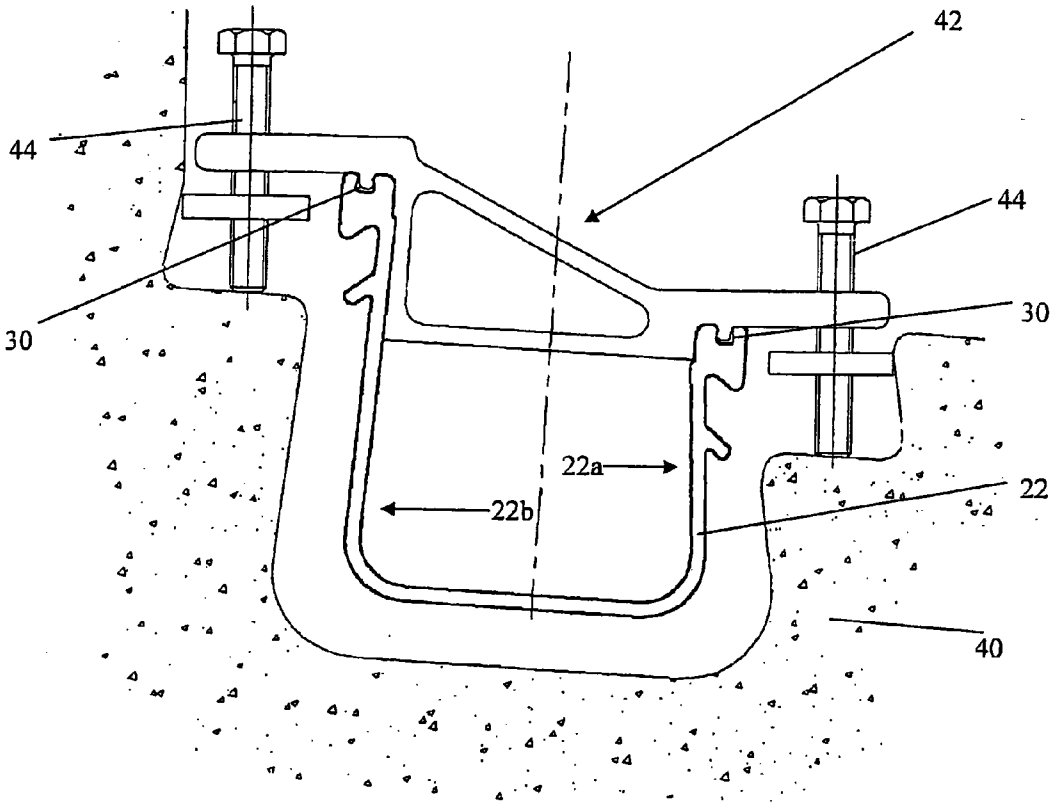


FIGURE 4

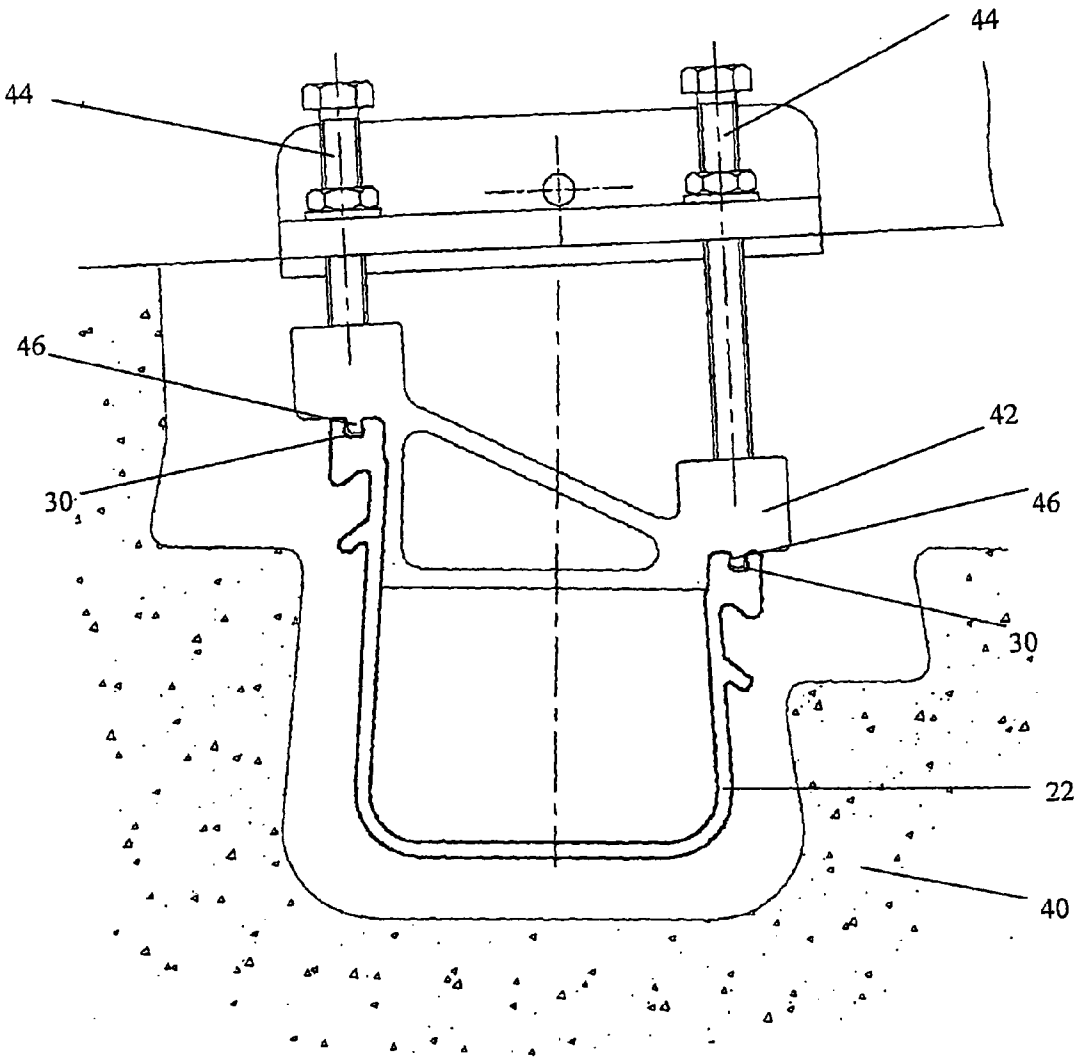


FIGURE 5

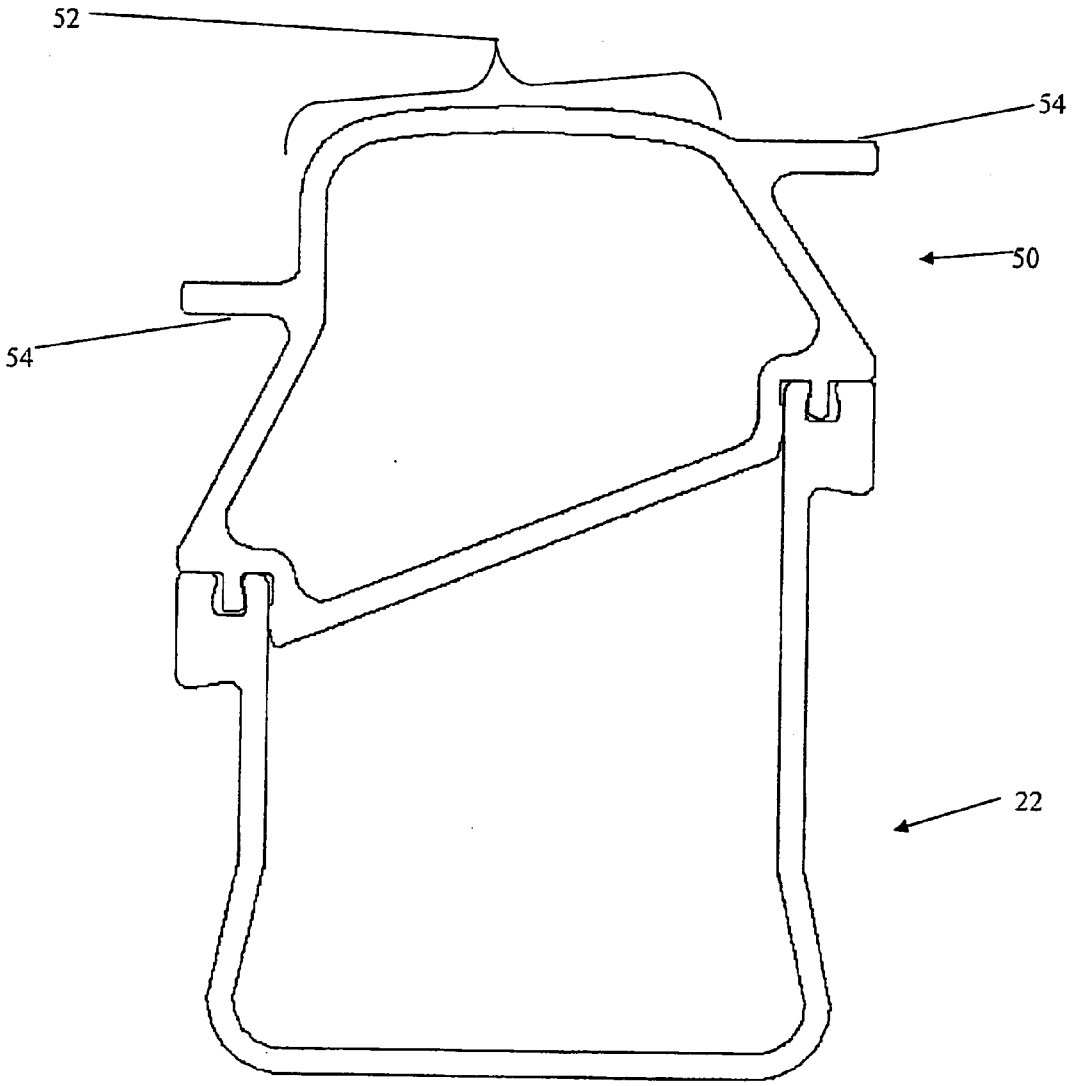


FIGURE 6

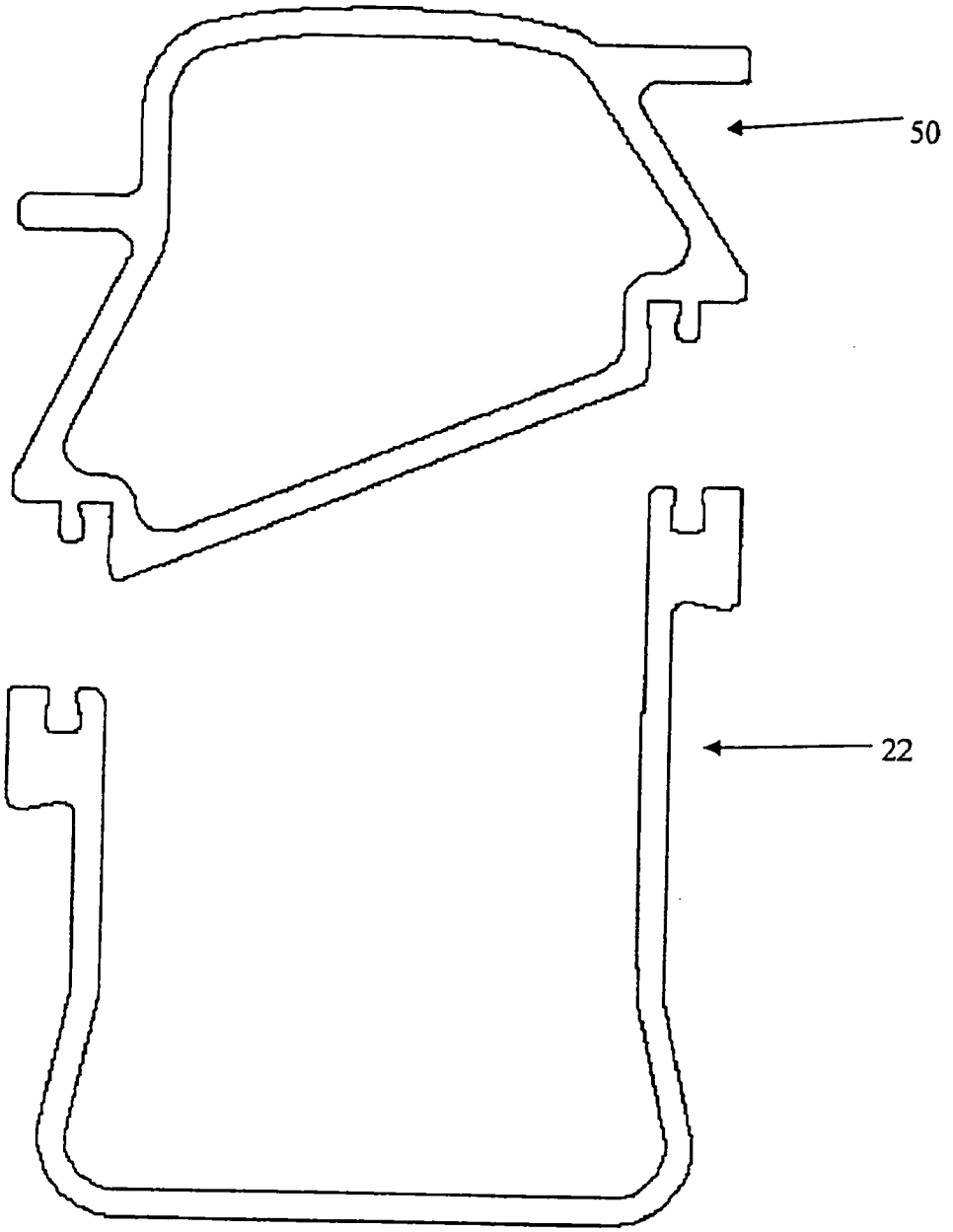


FIGURE 7

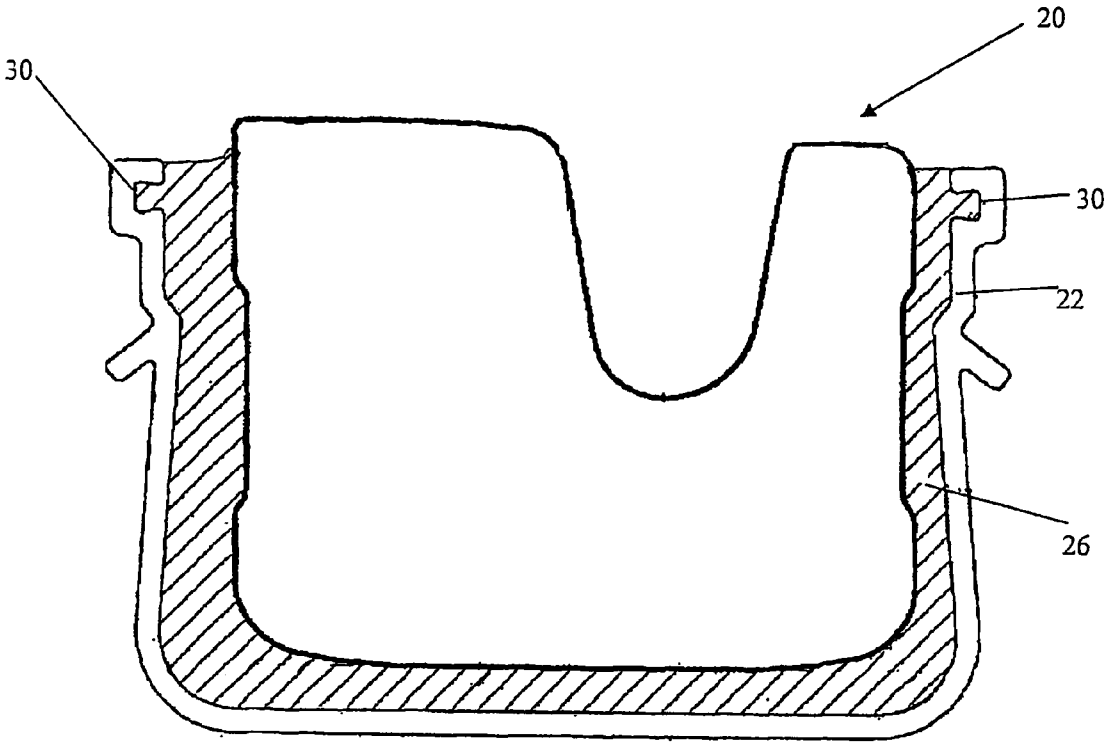


FIGURE 8

METHOD AND ARRANGEMENT FOR RAIL TRACK FIXING

FIELD OF THE INVENTION

[0001] This invention relates to rail track arrangements, particularly in which the rails are mounted in a continuous open channel.

BACKGROUND OF THE INVENTION

[0002] A conventional rail essentially comprises an I-beam, having a head, a narrow web and a base. The rails are supported at regular intervals by sleepers, and span the spacing between sleepers. The I-beam structure provides the required vertical strength of the rail across these spans.

[0003] An alternative rail design uses a continuous open channel, sometimes formed by a shell, to receive the rail. The rail has a substantially constant width, to enable it to be lowered into the channel. Any differences in width over the height of the rail are provided only to enable a push fit of the rail into the channel. The rail may have an I-beam cross section which is converted into the desired shape for lowering into the channel, using filler pieces. This invention relates to these types of rail configuration.

[0004] A resilient pad is typically provided between the rail and the channel. This resilient pad may be a preformed pad or alternatively may be an elastomer which is cast in place. The pad needs to provide some resilience, as the channel is typically cast into a fixed concrete base. Additional elements or components may be included in the assembly, such as filler pieces or noise or vibration damper components.

[0005] The use of a channel enables the concrete to be constructed to civil engineering tolerances, while the rail can be independently aligned to the tighter tolerances required for train support, and then cast in place.

[0006] This invention relates to the installation of railway track systems which utilise this open channel design, and this channel is referred to below as the container.

[0007] The rail, when fully installed and fixed in the track structure, may be held in place within the container using an arrangement which provides vertical, lateral, or longitudinal retention, or a combination of any of these. The container is typically arranged to continuously support the rail and resilient pad, and is concreted or grouted into or onto a solid base which may be continuous or in short or long segments, and may be concrete or steel for example. Typically the rail, the pad and the container are accurately aligned to the tight tolerance required for train operation before being grouted or concreted or fixed into their final position.

[0008] Various methods of supporting the components prior to and during concreting exist, which suspend the rail, the pad and container as a sub-assembly. These include support by gripping the railhead or by supporting or suspending the container.

[0009] The known installation methods also require the rail to be in place prior to concreting in order to ensure it is in the correct position for operational train traffic.

SUMMARY OF THE INVENTION

[0010] According to the invention, there is provided a method of laying a rail track arrangement, comprising:

[0011] temporarily fixing a support structure to a rail container, the support structure being fixed to the container using mounting points at upper regions of side walls of the container, wherein the support structure provides a fixed dimension between the side walls of the container;

[0012] suspending and moving the container to a desired position;

[0013] fixing the container to a base;

[0014] removing the support structure; and

[0015] inserting a rail into the container.

[0016] The invention enables the process by which the rail alignment is set to be separated from the rail fixing. In particular, the mounting points can be used to hold the container in a manner which simulates the presence of a rail in the container. The support structure holds the container side walls in a manner and position which fixes the dimensions to an acceptable tolerance.

[0017] The step of fixing the container to a base may comprise grouting or concreting the container into a concrete base, particularly grouting to a level substantially flush with the upper surfaces of the side walls of the container. The method provides the opportunity for the grouting to be mechanised, if required, using traditional civil engineering plant. It also enables the railing to be undertaken as a separate, fast and efficient operation with plant designed for that purpose.

[0018] This provides a simple railway solution with minimum components and a quick, easy implementation of a continuously supported track on concrete base. The installation costs are reduced as mechanisation is facilitated. The resulting stable rail gives reduced maintenance requirements, and increased safety (as a result of lack of buckling and containment of broken rails).

[0019] The method preferably further comprises inserting a resilient layer into the container before inserting the rail, and after removing the support structure. When inserting the resilient layer, upper lateral portions of the resilient layer can be clipped into the mounting points thereby to provide fixing of lateral seals. The mounting points of the container can thus provide the dual function of holding the container during positioning, and subsequently retaining the resilient layer to define lateral seals.

[0020] The support structure preferably comprises a lid which covers the top open part of the container. The lid may comprise a bracing strut which gives the required spacing between the lateral side walls of the container, with this spacing corresponding to the desired spacing when a rail is gripped in the container. For example, the lid may have at least a portion which references the position of a portion of the rail when. inserted into the container, and the lid portion is then used as a reference point for the step of moving the container to a desired position.

[0021] The lid may be shaped to correspond to the shape of the top of an inserted rail, so that the lid can be used for positioning in the same way that the rail itself would be used in previous installation methods.

[0022] The lid may be continuous, and this gives the advantage or preventing debris entering the container channel. However, the fixing operation provided by the lid can also be achieved with a discontinuous lid arrangement, for example a series of lid braces.

[0023] The invention also provides a rail track arrangement comprising:

[0024] a rail;

[0025] a container which receives the rail and which is grouted into a continuous base; and

[0026] a resilient layer between the container and the rail,

[0027] wherein the container has mounting points at an upper region of each side of the container, and wherein upper side portions of the resilient layer extend laterally over the mounting points at each side of the container and engage with the mounting points.

[0028] This aspect of the invention provides upper mounting points for the container (for example in the form of a "shell") in a continuous base ("slab") rail structure. As outlined above in connection with the method of the invention, these mounting points can be used for positioning of the container, and can enable the container to be grouted into position in a one stage process. Furthermore, the mounting points are also used to provide fixing locations for a seal, so that the full sealed assembly can be defined by three components (rail, pad and container).

[0029] The container is preferably grouted into the support structure using a one-stage grouting operation, and the support structure comprises a concrete base having a channel. The grout may then reach substantially the level of the mounting points, and the upper side portions of the resilient layer extend laterally over the top of a part of the grout layer. In this way, the two side top parts of the resilient layer define a seal extending right over the top edges of the container and across to the finished grout.

[0030] The invention also provides a support arrangement for receiving a rail, comprising:

[0031] a container for receiving the rail; and

[0032] a resilient layer lining an inner channel of the container,

[0033] wherein the container is grouted into a support structure, and the container has mounting points at an upper region of each side of the container, the mounting points being set with a predetermined spacing to provide desired compression of the rail when inserted as a push fit.

[0034] This support arrangement is installed without needing the rail, and is designed to provide the required dimensions for the container to grip a subsequently inserted rail in the desired manner.

[0035] The invention also provides rail installation equipment for installing a rail track arrangement comprising a rail, a container which receives the rail and a resilient layer between the container and the rail, the equipment comprising:

[0036] a support structure for releasably suspending the container using fixings which engage with mounting points at upper regions of side walls of the container, wherein the support structure provides a fixed distance between the side walls of the container; and

[0037] a positioning arrangement for positioning the container by moving the support structure.

[0038] The invention also provides a rail container arrangement for a rail track arrangement comprising a rail, the container which receives the rail and a resilient layer between the container and the rail, the rail container arrangement comprising:

[0039] a base part having lateral side walls and defining a channel for receiving a rail, each lateral side wall having a mounting point at an upper region; and

[0040] a top part, the top part having fixing points for releasable fixing to the mounting points, the top part providing a fixed relative position between the side walls during positioning and installation of the base part.

BRIEF DESCRIPTION OF THE DRAWINGS

[0041] Examples of the invention will now be described in detail with reference to the accompanying drawings in which:

[0042] FIG. **1** shows a known rail cross section for use in the so-called "embedded Rail Track" system; and

[0043] FIG. **2** shows a rail track arrangement of the invention and installed using the method of the invention;

[0044] FIG. **3** shows a second example of rail track arrangement of the invention and installed using the method of the invention;

[0045] FIG. **4** shows a first way of implementing the installation method of the invention;

[0046] FIG. **5** shows a second way of implementing the installation method of the invention;

[0047] FIG. **6** shows an alternative design of container and lid of the invention, releasably fixed together;

[0048] FIG. **7** shows the design of container and lid of FIG. **5**, released from each other; and

[0049] FIG. **8** shows the invention applied to a tramway rail.

[0050] FIG. **1** shows a known embedded rail design. The rail **20** is held in a container or shell **22** set in a bed or slab **24** of concrete. The container **22** has an inner profile of an open channel to receive the rail **20** whilst also clamping the rail **20** in place. A resilient filler **26** is provided between the container **22** and the rail **20**.

[0051] The rail cross section comprises a head portion **20**A and a supporting portion **20**B. In the example shown in FIG. **2**, the top of the supporting portion **20**B has a pinched part **28**. To insert the rail **20** into the container **22**, the wider lower part of the supporting portion **20**B has to pass through the pinched region of the fill **26**, so that the rail must effectively be sprung into the container with a snap-action fit.

[0052] Despite this pinched part **28** of the rail cross section, the head portion **20**A and the supporting portion **20**B have substantially the same width. The only differences in width are provided to enable the snap-action fitting of the rail into the container as described above.

[0053] The bed or slab **24** is lower on one side of the rail than on the other side, to allow the passage of the flange of a wheel of the railed vehicle. However, the container **22** provides support on both sides of the rail.

[0054] The rail design of FIG. **1** is described in greater detail in WO 99/63160. The container **22** defines a continuous supporting structure for the rail **20**, rather than the discontinuous sleeper arrangement of more conventional rail designs.

[0055] The invention relates to the installation of rail arrangements using a container to receive the rail in a push fit manner, as described above. Conventional installation involves forming a sub-assembly of the rail, resilient pad and container, and holding these in the position which gives the desired rail position. The rail position is monitored during the installation adjustments, and the sub-assembly is fixed into position when the desired rail position is obtained.

[0056] This technique, requiring all components including the rail, pad and temporary support system to be present during aligning and fixing, limits the possibilities of optimising the installation process and mechanisation parts of the process.

[0057] The known installation methods also present difficulties in maintaining the dimension tolerances required for:

[0058] (i) the cast in place assembly to avoid water and material ingress particularly where and when the intent is that the rail is removable;

[0059] (ii) the insertion, retention and the removal of a rail; and

[0060] (iii) the desired lateral and longitudinal gripping of the rail.

[0061] FIG. **2** shows an installed rail installation of the invention.

[0062] The installation again comprises a rail **20** (with substantially rectangular cross section), a container **22** in the form of a shell which receives the rail; and a resilient layer **26** between the container and the rail. In accordance with the invention, the container **22** has mounting points **30** at an upper region of each side **22***a*, **22***b* of the container. These mounting points are shown as tapered channels for receiving a lug. The lug may snap into and out of the tapered channel. Many other forms of clipping or latching arrangement could be envisaged. However, the mounting points are preferably defined as a shape feature of the container **22** so that the container can simply be produced in the desired shape, with the shape defining the mounting points **30**.

[0063] The primary function of the mounting points is to enable the dimension between the side walls of the container **22** to be fixed during installation, as will be discussed below. This enables the correct gripping characteristics of the rail.

[0064] Upper side portions **32** of the resilient layer **26** extend laterally over the mounting points **30** at each side of the container and engage with the mounting points **30**. These portions **32** thus have lugs **34** for clipping into the tapered recess. The later insertion of the resilient layer **26**, which may be a pre-formed extruded member, into the container thus also covers the joint between the grout layer **24** and the support structure.

[0065] The mounting points **30** perform an additional function to the sealing function described above, and this additional function relates to the installation method, which is described below. In particular, the mounting points **30** are used for positioning of the container, and enable the container to be grouted into position in a one stage process.

[0066] An I-beam shaped rail can also be used, in conjunction with filler blocks that simulate the substantially rectangular shape of the assembly to enable the same rail retention method.

[0067] FIG. **3** shows a second example of installed rail installation of the invention, and uses the same reference numbers as FIG. **2** In this case, the rail **20** has an I-beam cross section, and filler pieces **35** on each side of the web convert the outer shape of the rail into a substantially rectangular cross section to be received as a push fit in the container. FIG. **3** also shows that the side walls **22***a*, **22***b* of the container **22** may have the same height.

[0068] The method of the invention will be explained with reference to FIGS. **4** and **5**. In order to position the container **22**, it is suspended in an opening in the concrete base **40** using a support structure **42**. In the example shown in FIG. **4**, the support structure is essentially a strut brace which fixes the spacing between the sides of the container. This strut is temporarily fixed to the container using the mounting points **30**, as shown. The container can then be moved to a desired position using the support structure **42**, and FIG. **3** shows screw adjustment legs **44** which seat at the base of the opening in the concrete base **40** for this purpose. These are adjusted until the container is in the desired position, and it is then fixing into the base, for example by a first stage of a grouting operation. The support structure **42** is then removed, and the grouting is finished if need be. Only then are the resilient layer and rail inserted into the container.

[0069] The support structure **42** is designed to ensure that the dimensions are accurate to give the desired characteristics for the subsequent insertion of the rail and resilient layer. This ensures the assembly seals well, and that the rail is retained within, and can be removed from, the container with the desired forces. The support structure may fix the distance between the sides walls to prevent any movement of the side walls together or apart, as in the examples above. However, the support structure may only be required to prevent inward collapse of the side walls, as the grouting operation will force the sides inwardly, and there may then be no need to resist outward movement of the side walls. This could then allow easier removal of the support structure from the container after the container has been fixed in place.

[0070] FIG. **5** shows a similar arrangement to FIG. **3**, but shows the support structure suspending the container from above. Adjustment screws **44** are again provided for positioning, but in this example, once the desired position has been reached, a one-stage grouting step can be carried out, right up to the level of the mounting points **30**, to provide the full grout layer **24** as shown in FIG. **2**. The grouting can be mechanised using traditional civil engineering plant.

[0071] If the container is gripped, it is not possible to implement a one-stage grouting operation. Instead, an initial grouting step is performed up to the grip points, and the container is then released. A second grouting step then completes the installation. If the rail head is gripped, there may be some relaxation of the shape of the container, so that once it has been grouted (or fixed using a different method) into place, the desired retention characteristics of the rail may not be maintained. Thus, the existing installation methods also do not facilitate, to the degree required for well engineered track, the holding of the rail with the ideal force at all positions around its surface and along its length.

[0072] In this design, the support structure is fixed to the container such that the support structure does not impede any grout or concrete.

[0073] The support structure holds the container by the mounting points with sufficient strength to enable movement of the container into position. However, once the grouting has been completed (or a partial grouting has been completed), the strength of the coupling between the support structure and the container can be overcome by lifting the support structure fixing points **46**. Additional fixing devices could be used, such as clips, bolts etc, if desired.

[0074] Once the container is in place, the resilient layer is clipped into place in the manner explained above, and the rail is inserted as a separate operation.

[0075] In another example, shown in FIGS. **6** and **7**, the support structure comprises a lid **50** which closes the top open part of the container **22**. In the previous examples, a bracing strut was used. In this example, in addition to giving the required spacing between the lateral side walls of the container **22**, the lid is also shaped to correspond to the shape of the top of an inserted rail, so that the lid can be used for positioning in the same way that the rail itself would be used in previous installation methods.

[0076] In particular, currently available rail alignment equipment can run along the top surface of the cover as if running along the final rail.

[0077] For example, the lid has a portion **52** which corresponds in position to the position of a portion of the rail when inserted into the container **22**. This lid portion is then used as a reference point for the step of moving the container to a desired position.

[0078] The lid also has additional support elements **54**, and these can be used for automated positioning of the container assembly. Any fixings suitable for the positioning equipment can be provided.

[0079] FIG. **7** shows the rail container arrangement of FIG. **5** with the lid **50** and base **22** separated.

[0080] The invention enables a rail support system to be set accurately in place and enables the position to be checked prior to final casting the support system, without the presence of the rail such that when the rail is later installed it has the required alignment tolerances. The space for the rail and resilient pad can be consistently and accurately pre-defined, without the need to apply compressive forces at the alignment stage, which can be required with the rail in position.

[0081] By maintaining the internal dimensions of the container, it is possible to provide, through the pad and its compression on installation of the rail, the correct horizontal (lateral and longitudinal) grip and support to the rail and the required value of the horizontal resilience and longitudinal restraint.

[0082] Different bracing strut or lid designs and dimensions can be used to change the horizontal grip or pre compression on the rail when it is inserted. This enables the characteristics of the installation to be varied at different points, to suit local specific requirements, while still ensuring the rail can be inserted and removed.

[0083] Standard rail gauging equipment (trolleys, gauge bars etc.) can be used for the positioning of the container, in particular by providing lid reference points corresponding to the rail.

[0084] The use of a lid or bracing strut that covers the channel keeps out the dust and extraneous materials during construction, and this minimises the cost and time of cleaning out the container.

[0085] The invention enables the alignment and fixing a container which has a significantly lower weight per unit length and a greater stiffness to weight ratio. This requires less force and less complexity of handling equipment than with the rail in place. The rail installation can be a later event when it can be done quickly, efficiently and with cost effective equipment designed for that purpose as the alignment will already be preset.

[0086] The supporting and gripping facility **54** on the lid enables the use of lightweight automated equipment to effect container installation. Long lengths of container can be supported and aligned by automated and mechanical means at one time making rapid speed and low cost installation possible. The rail alignment will also remain throughout the life of the rail as it is set by the container installation.

[0087] The alignment of the container through joints between consecutive lengths can be kept smooth by staggering the cover joints and the container joints so that they do not coincide, with or without the need for connector pieces.

[0088] Resetting of the alignment after rail removal and replacement may be avoided as the alignment remains permanently fixed and within the allowable tolerances. No time is lost setting up the alignment for subsequent rail insertions. If there is damage to the container or grout, resetting of the assembly can be performed using the same equipment as used for the original installation.

[0089] The rail can be removed and replaced from the installation without any need for adjustment of any fixings, as the lateral pre compression of the resilient pad remains consistent and correct along its length.

[0090] The cover can be reused for different installations, and does not therefore represent a significant additional cost item for the installation.

[0091] When the desired maximum lateral and vertical pad pre compression values are exceeded the rail can slip through the pad or the pad through the container to ensure no damage occurs to the pad or container.

[0092] In the example above, the container (shell) is positioned before insertion of the resilient pad and rail. However, the resilient pad may be installed with the container if desired, for example with the side walls of the resilient pad pushed inwardly to reveal the mounting points.

[0093] The invention may be applied to railways as well as tramways. By way of example, FIG. **8** shows another example of rail track arrangement in which the rail **20** has a channel with a substantially level top surface on each side. This example also shows the mounting points **30** located at an inner side of the top region of each side wall of the container.

[0094] In all examples, the container and cover may be straight, and they could be bent around curves when installed. The closed form of the lid (as clearly seen in FIG. **7**) prevents buckling when the lid is gently deformed into the desired radius of curvature. However, there may also be curved sections, and the cover and container can then be designed to cooperate without distorting.

[0095] The support structure (lid) may provide different spacing between the side walls of the container around bends, and also the resilient layer may be designed differently for different curves, or for other differences which affect the load to be experienced. Thus, different lid designs may be used and/or different resilient layer designs for different radii of curvature. Typically, the resilient layer may be provided in relatively short lengths, for example 2 m.

[0096] This enables a continuously variable track geometry to be defined, and this is made possible by the engineering accuracy with which the container can be fixed into position. The invention thus provides an installation method and apparatus enabling this continuously variable track geometry.

[0097] The support structure, which is used to hold the container in place during fixing, may be an integrated part of the concreting/grouting apparatus.

[0098] The mounting points may provide the further function of alignment between container sections, for example they may be designed to accommodate a trace heating cable or a clip, in order to maintain alignment through container joints (whether or not a cover is present).

[0099] The rail has been shown as a single metal item. However, as shown in FIG. **3**, the substantially rectangular outer shape may be defined by an I-beam shaped metal rail together with inserts which convert the I-beam shape into a rectangular shape. These inserts may also perform a damping function as well as providing the desired shape for snap fitting of the rail in the container.

[0100] In the examples described above, the container arrangement is grouted into a channel in a concrete base which has previously been installed. The container arrange-

ment can be mounted on a discontinuous base such as sleepers, for example a discontinuous steel base. A further alternative is for the concrete base to be provided as part of the installation process, so that the container arrangement is held by the support structure (the lid) for a one-pour concreting operation which defines the full support structure around the container. The position of the container can be verified by the support structure even when a lower part of the container has no easily accessible reference points.

[0101] Various other modifications will be apparent to those skilled in the art.

1. A method of laying a rail track arrangement, comprising:
temporarily fixing a support structure to a rail container, the support structure being fixed to the container using mounting points at upper regions of side walls of the container, wherein the support structure provides a fixed dimension between the side walls of the container;
suspending and moving the container to a desired position;
fixing the container to a base;
removing the support structure; and
inserting a rail into the container.

2. A method as claimed in claim **1**, wherein the support structure is used to move the container to the desired position.

3. A method as claimed in claim **1** or **2**, further comprising inserting a resilient layer into the container before inserting the rail, and after removing the support structure.

4. A method as claimed in claim **3**, wherein inserting a resilient layer comprises clipping upper lateral portions of the resilient layer into the mounting points thereby to provide lateral seals.

5. A method as claimed in any preceding claim, wherein fixing the container to a base comprises grouting the container into a concrete base.

6. A method as claimed in claim **5**, wherein grouting the container into a concrete base comprises grouting to a level substantially flush with the upper surfaces of the side walls of the container.

7. A method as claimed in any preceding claim, wherein the support structure comprises a lid which covers the top open part of the container.

8. A method as claimed in claim **7**, wherein the lid has at least a portion which corresponds in position to the position of a portion of the rail when inserted into the container.

9. A method as claimed in claim **8**, wherein the lid portion is used as a reference point for the step of moving the container to a desired position.

10. A method as claimed in any preceding, claim, wherein the fixed dimension between the side walls of the container is set to provide desired compression of the rail when inserted as a push fit.

11. Rail installation equipment for installing a rail track arrangement comprising a rail, a container which receives the rail and a resilient layer between the container and the rail, the equipment comprising:
a support structure for releasably suspending the container using fixings which engage with mounting points at upper regions of side walls of the container, wherein the support structure provides a fixed distance between the side walls of the container; and
a positioning arrangement for positioning the container by moving the support structure.

12. Equipment as claimed in claim **11**, wherein the support structure comprises a lid which covers the top open part of the container.

13. Equipment as claimed in claim **12**, wherein the lid has at least a portion which corresponds in position to the position of a portion of the rail when inserted into the container.,

14. Equipment as claimed in claim **13**, wherein the lid portion is used as a reference point for the positioning arrangement.

15. A rail container arrangement for a rail track arrangement comprising a rail, the container which receives the rail and a resilient layer between the container and the rail, the rail container arrangement comprising:
a base part having lateral side walls and defining a channel for receiving a rail, each lateral side wall having a mounting point at an upper region; and
a top part, the top part having fixing points for releasable fixing to the mounting points, the top part providing a fixed relative position between the side walls during positioning and installation of the base part.

16. A rail container arrangement as claimed in claim **15**, wherein the top part comprises a lid which covers the top open part of the channel.

17. A rail track arrangement comprising:
a rail;
a container which receives the rail and which is grouted into a continuous base; and
a resilient layer between the container and the rail,
wherein the container has mounting points at an upper region of each side of the container, and wherein upper side portions of the resilient layer extend laterally over the mounting points at each side of the container and engage with the mounting points.

18. An arrangement as claimed in claim **17**, wherein the continuous base comprises a concrete base.

19. An arrangement as claimed in claim **17** or **18**, wherein the grout reaches the level of the mounting points, and the upper side portions extend laterally over the top of a part of the grout layer.

20. An arrangement as claimed in claim **17**, **18** or **19**, wherein the cross section of the rail, perpendicular to the rail length, comprises a head portion and a supporting portion having substantially the same width.

21. An arrangement as claimed in any one of claims **17** to **19**, wherein the cross section of the rail, perpendicular to the rail length, comprises a head portion, a base portion and a narrower intermediate web portion, and wherein filler pieces are provided adjacent each side of the web portion such that the outer shape of the rail and filler portions is substantially rectangular.

22. A support arrangement for receiving a rail, comprising:
a container for receiving the rail; and
a resilient layer lining an inner channel of the container,
wherein the container is grouted into a support structure, and the container has mounting points at an upper region of each side of the container, the mounting points being set with a predetermined spacing to provide desired compression of the rail when inserted as a push fit.

23. A support arrangement as claimed in claim **22**, wherein the predetermined spacing varies along the length of the container.

24. A support arrangement as claimed in claim **22** or **23**, wherein the cross sectional shape of the resilient layer, perpendicular to the rail direction, varies along the length of the container.

25. A support arrangement as claimed in any one of claims **22** to **24**, wherein upper side portions of the resilient layer extend laterally over the mounting points at each side of the container and engage with the mounting points.

* * * * *